Physics 1401
Simple Harmonic Motion Review

5. A vertical block-spring system on earth has a period of 6.0 s. What is the period of this same system on the moon where the acceleration due to gravity is roughly 1/6 that of earth?

(a) 1.0 s **(c) 6.0 s** (e) 36 s
(b) 2.4 s (d) 15 s

6. Which one of the following statements is true concerning an object executing simple harmonic motion?

(a) Its velocity is never zero.
(b) Its acceleration is never zero.
(c) Its velocity and acceleration are simultaneously zero.
(d) Its velocity is zero when its acceleration is a maximum.
(e) Its maximum acceleration is equal to its maximum velocity.

7. When a force of 20.0 N is applied to a spring, it elongates 0.20 m. Determine the period of oscillation of a 4.0-kg object suspended from this spring.

(a) 0.6 s (c) 3.1 s (e) 6.3 s
(b) 1.3 s (d) 4.1 s

11. A ball hung from a vertical spring oscillates in simple harmonic motion with an angular frequency of 2.6 rad/s and an amplitude of 0.075 m. What is the maximum acceleration of the ball?

(a) 0.13 m/s^2 **(c) 0.51 m/s^2** (e) 35 m/s^2
(b) 0.20 m/s^2 (d) 2.6 m/s^2

12. The acceleration of a certain simple harmonic oscillator is given by

$$a = -(15.8 \text{ m/s}^2) \cos (2.51t).$$

What is the amplitude of the simple harmonic motion?

(a) 2.51 m (c) 6.30 m (e) 15.8 m
(b) 4.41 m (d) 11.1 m

13. A 1.0-kg object is suspended from a spring with k = 16 N/m. The mass is pulled 0.25 m downward from its equilibrium position and allowed to oscillate. What is the maximum kinetic energy of the object?

(a) 0.25 J (c) 1.0 J (e) 4.0 J
(b) 0.50 J (d) 2.0 J

14. A spring required a force of 1.0 N to compress it 0.1 m. How much work is required to stretch the spring 0.4 m?

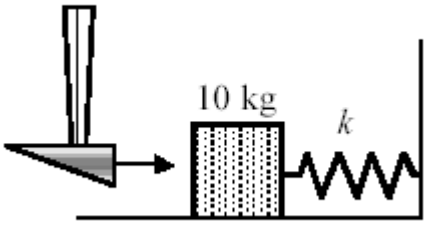
(a) 0.4 J **(c) 0.8 J** (e) 4 J
(b) 0.6 J (d) 2 J

15. A certain spring compressed 0.20 m has 10 J of elastic potential energy. The spring is then cut into two halves and one of the halves is compressed by 0.20 m. How much potential energy is stored in the compressed half of the spring?

(a) 5 J (c) 14 J (e) 40 J
(b) 10 J **(d) 20 J**

16. A 10-kg box is at rest at the end of an unstretched spring with constant k = 4000 N/m. The mass is struck with a hammer giving it a velocity of 6.0 m/s to the right across a frictionless surface. What is the amplitude of the resulting oscillation of this system?

(a) 0.3 m (d) 0.6 m
(b) 0.4 m (e) 2 m
(c) 0.5 m



17. A 1.0-kg block oscillates with a frequency of 10 Hz at the end of a certain spring. The spring is then cut into two halves. The 1.0-kg block is then made to oscillate at the end of one of the halves. What is the frequency of oscillation of the block?

(a) 5 Hz **(c) 14 Hz** (e) 40 Hz
(b) 10 Hz (d) 20 Hz

21. The spring constant for the spring in a special cannon is 1800 N/m. In cocking the cannon, the spring is compressed 0.55 m. What is the initial speed of a 7.0-kg cannonball at rest on the free end of the spring when it is released?

(a) 77 m/s (c) 12 m/s (e) 16 m/s
(b) 140 m/s **(d) 8.8 m/s**

25. A pendulum is transported from sea-level, where the acceleration due to gravity g = 9.80 m/s^2, to the bottom of Death Valley. At this location, the period of the pendulum is decreased by 3.00%. What is the value of g in Death Valley?

(a) 9.22 m/s^2 (c) 9.80 m/s^2 **(e) 10.4 m/s^2**
(b) 9.51 m/s^2 (d) 10.1 m/s^2

26. In a certain clock, a pendulum of length L_1 has a period $T_1 = 0.95$ s. The length of the pendulum is adjusted to a new value L_2 such that $T_2 = 1.0$ s. What is the ratio L_2/L_1?

(a) 0.90 (c) 1.0 (e) 1.3
(b) 0.95 **(d) 1.1**

27. What is the period of a pendulum consisting of a 6-kg object oscillating on a 4-m string?

(a) 0.25 s (c) 1.0 s **(e) 4.0 s**
(b) 0.50 s (d) 2.0 s

28. A simple pendulum consists of a ball of mass m suspended from the ceiling using a string of length L. The ball is displaced from its equilibrium position by an angle Θ. What is the magnitude of the restoring force that moves the ball toward its equilibrium position and produces simple harmonic motion?

(a) kx (c) mg (cos Θ) (e) mgL(sin Θ)
(b) mg **(d) mg (sin Θ)**

30. A simple pendulum on earth has a period of 6.0 s. What is the approximate period of this pendulum on the moon where the acceleration due to gravity is roughly 1/6 that of earth?

(a) 1.0 s (c) 6.0 s (e) 36 s
(b) 2.4 s **(d) 15 s**

[Physical pendulums problems will not be on the Exam - only simple pendulum problems.]

31. A thin, circular hoop with a radius of 0.22 m is hanging on a nail. Adam notices that the hoop is oscillating back and forth through small angles like a physical pendulum. The moment of inertia of the hoop for the rotational axis passing through the nail is $I = 2mr^2$. What is the period of the hoop?

(a) 0.21 s (c) 0.59 s **(e) 1.3 s**
(b) 0.42 s (d) 0.94 s